



First verified record of *Mastigodryas melanolumus* (Cope, 1868) (Serpentes, Colubridae) from Isla del Coral, Nayarit, Mexico

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Abstract. The occurrence of the Salmon-bellied Racer, *Mastigodryas melanolumus* (Cope, 1868), on the Isla del Coral in the Pacific coast of Mexico is confirmed through the examination of squamation and the use of other morphological characters. Additionally, we conducted a morphological analysis to assess the differences between *M. melanolumus* and *Masticophis lineatus* (Bocourt, 1890), which was previously reported on the island. The results of our analysis suggest a possible misidentification of the previous record. Further investigations and explorations will yield additional insights about whether both species occur on Isla del Coral.

Key words. Insular environment, morphology, Pacific Ocean, reptiles, taxonomy

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INTRODUCTION

The herpetological exploration of the islands in western Mexico has significantly increased in the last two decades, leading to the discovery of several new records of frogs (De la Torre et al. 2010; Ramírez-Reyes et al. 2015; Nolasco-Luna et al. 2017), lizards (Ramírez-Reyes et al. 2015), and snakes (Nolasco-Luna et al. 2017, 2019, 2022). Advancements in molecular tools have played a crucial role in supporting taxonomic descriptions. As a result, three new species of leaf-toed geckos have been identified: *Phyllodactylus cleofasensis* Ramírez-Reyes, Barraza-Soltero, Nolasco-Luna, Flores-Villela & Escobedo-Galván, 2021 from Isla María Cleofas, *P. isabelae* (Castro-Franco & Uribe-Peña, 1992) from Islas Marietas, and *P. lupitae* (Castro-Franco & Uribe-Peña, 1992) from Isla del Coral. The latter island is the smallest in the state of Nayarit, Mexico, with a surface area of 0.12 km² and approximately 1.80 km of distance from the mainland (Figure 1).

To our knowledge, only two sampling efforts have been conducted to assess the herpetofaunal diversity on Isla del Coral. Stemming from the first field effort, Castro-Franco and Gaviño (1990) and Castro-Franco and Uribe-Peña (1992) reported five lizard and two snake species: *Anolis nebulosus* (Wiegmann, 1934), *Ctenosaura pectinata* (Wiegmann, 1834), *Aspidoscelis lineattissima* (Cope, 1878), *Phyllodactylus lupitae*, *Urosaurus bicarinatus* (Duméril, 1856), *Hypsilema torquata* (Günther, 1860), and *Masticophis lineatus* (Bocourt, 1890); for the taxonomic status of *M. lineatus*, see O'Connell and Smith (2018). During the second exploration, Ramírez-Reyes et al. (2015) visited the Isla del Coral, where they collected *Rhinella horribilis* (Wiegmann, 1833) and *Hemidactylus frenatus* Duméril & Bibron, 1836. Therefore, the herpetofaunal diversity of the Isla del Coral, consists of nine species: one toad (*R. horribilis*), six lizards (*A. nebulosus*, *A. lineattissima*, *C. pectinata*, *H. frenatus*, *P. lupitae*, and *U. bicarinatus*), and two snakes (*H. torquata*, and *M. lineatus*). Here, we report the first record of Salmon-bellied Racer, *Mastigodryas melanolumus* (Cope, 1868), from Isla del Coral.

METHODS

On 11 June 2022, we visited Isla del Coral, which is located off the southern coast of the state of Nayarit, in front of the town of Rincon de Guayabitos (21°02'52"N, 105°16'21"W; Figure 1). The island has an approximate surface area of 12 ha and is characterized by tropical subdeciduous and deciduous forests (Castro-Franco and Gaviño 1990).



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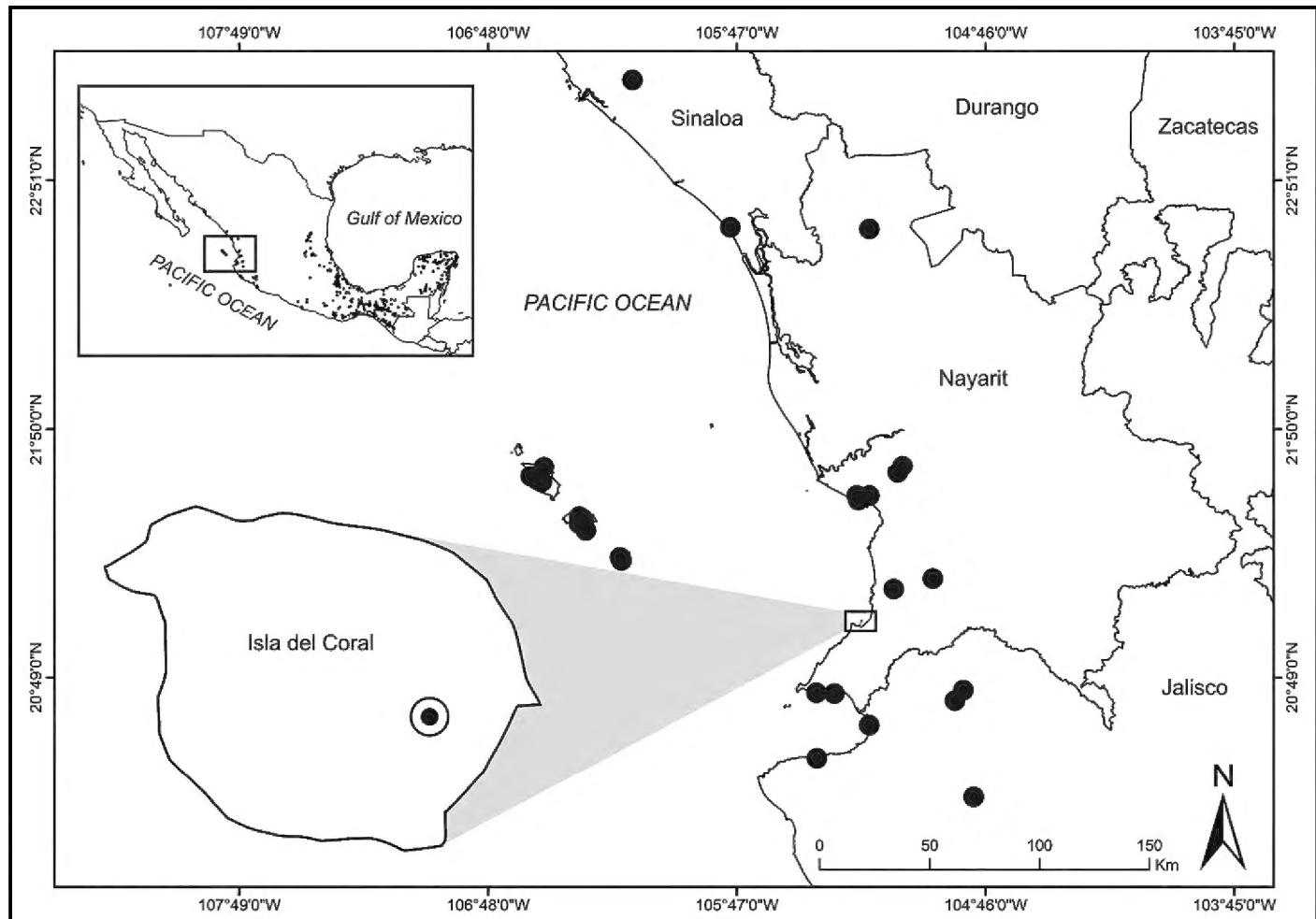


Figure 1. Map showing the new record of *Mastigodryas melanolomus* from the Isla del Coral, Nayarit, Mexico. Black circles on mainland showed the previous records of the study species (GBIF Secretariat 2024).

Incidental surveys were conducted from 1200 to 1600 h. We observed and captured an individual of *Mastigodryas melanolomus*, which was deposited in the herpetological collection of the Zoological Museum of the Facultad de Estudios Superiores Zaragoza, Universidad Nacional Autónoma de México (**MZFZ**), and a photograph of this specimen *in situ* was deposited in the Colección Nacional de Anfibios & Reptiles at Universidad Nacional Autónoma de México (**IBH-RF**). We identified the *M. melanolomus* specimen using the identification key of Zweifel (1960). Squamation details were obtained following the methodology described by Pérez-Higareda et al. (2007). We also sought consultation from two Mexican herpetologists regarding the snake's identity. However, discrepancies between *Masticophis lineatus* (previously recorded on the island) and *Mastigodryas melanolomus* were identified. Specifically, Rubén Castro-Franco (2022 pers. comm.) identified our specimen as *Masticophis lineatus*, while Marco A. López-Luna (2022 pers. comm.) identified it as *Mastigodryas melanolomus*. To establish a definitive identification of the snake from Isla del Coral, we performed a morphological analysis. Three meristic characters were measured: snout–vent length (**SVL**), from the tip of the snout to the anterior margin of the cloaca; head length (**HL**), from the tip of the snout to the anterior margin of the ear; and head width (**HW**), measured at the widest point of head. Morphological data of *M. melanolomus* ($n = 5$) and *Masticophis lineatus* ($n = 13$) were obtained from specimens deposited in the Smithsonian Institution, National Museum of Natural History (**USNM**; Washington, DC) and the American Museum of Natural History (**AMNH**; New York, New York). We conducted a similarity analysis using one-way ANOSIM (Clarke 1993) with untransformed data to determine differences between *M. melanolomus* and *M. lineatus*, where an *R* value of 1 indicates differences between groups, while an *R* value of 0 suggests little or no segregation into groups (Clarke and Warwick 2001). These data were visualized using non-parametric multidimensional scaling (NMDS) along two dimensions, employing Gower distance. The efficiency of NMDS was evaluated based on the stress value scale proposed by Fasham (1977). All analyses were performed using PAST v. 3.15 (Hammer et al. 2001).

RESULTS

Mastigodryas melanolomus (Cope, 1868)

Figure 2

Material examined. MEXICO – NAYARIT • Isla del Coral; 21°02'52.0"N, 105°16'20.9"W; elev. 20 m; 11.V.2022; Eduardo A. Gómez-Hernández obs.; 1♂, MZFZ-4566, IBH-RF-749 (photograph).

The specimen was found on the ground, within a microhabitat characterized by rocks and leaf litter (Figure 2A). The snake was active at 13:30 h. Its SVL is 74 cm, the tail length is 35 cm, and the relative tail length (tail length/SVL) is 0.47.

Identification. Scutellation characteristics of the specimen (Figure 2B, C) were: 177 ventrals, 122 subcaudals, 15 rows, 9-9 supralabials, 8-8 infralabials, 1 preocular, 1 postocular, and 4th, 5th and 6th infralabial in contact with the orbit (Table 1). The specimen shows a particular characteristic in the fourth supralabial scale on both sides, on the right side the scale is divided in two horizontally, and on the left side it is incomplete

(it does not touch the lip; Figure 3). Overall, the scutellation of the individual from Isla del Coral falls within the ranges reported for *M. melanolomus*. Furthermore, the one-way ANOSIM test confirmed a clear distinction between *Mastigodryas melanolomus* and *Masticophis lineatus* (R -value = 0.96, $P < 0.01$). The NMDS ordination also revealed an accurate separation between both species, revealing that the specimen from Isla del Coral falls within the morpho-space of *M. melanolomus* (Figure 4).

Remarks. *Mastigodryas melanolomus* has been recorded previously on Isla María Madre (USNM 24675), Isla María Magdalena (USNM 24679), and Isla María Cleofas (IBH-RF-706), which comprise the Islas Marías Archipelago Biosphere Reserve (Stejneger 1899; Zweifel 1960; Nolasco-Luna et al. 2022). This species was assessed as Least Concern by the IUCN (Lee et al. 2013), and Wilson et al. (2013) gave it a low environmental vulnerability score (EVS = 6). Its conservation status, however, has not been assessed by SEMARNAT.

DISCUSSION

Based on our results and review, this is the first verified record of the *Mastigodryas melanolomus* on Isla del Coral, Nayarit, México (Rodríguez Malagón et al. 2012a, 2012b). Castro-Franco and Gaviño (1990) recorded *Masticophis lineatus* from Isla del Coral, which created uncertainty regarding the occurrence of and distribution overlap with *Mastigodryas melanolomus*. However, the morphological analysis has proved to be a valuable tool in distinguishing between species that exhibit similar morphological characteristics (e.g. Pazos-Nava et al. 2019). The verified occurrence of *M. melanolomus* on Isla del Coral raises ecological questions about the coexistence of both species on the island. To our knowledge, *M. melanolomus* and *M. lineatus* are sympatric in some islands, such as Isla María Madre and Isla María Magdalena, which are the two largest islands in the Islas Marías Archipelago Biosphere Reserve. Surprisingly, only one of these species has been recorded on islands with a surface area smaller than 25.1 km². For instance, *Mastigodryas melanolomus* has been recorded on Isla María Cleofas with a surface area of 25 km² (Nolasco-Luna et al. 2022), whereas *Masticophis lineatus* was reported on Isla San Juanito with 8 km² (Zweifel 1960) and Islas Marietas with a surface area less than 1 km² (Casas-Andreu 1992). The above information suggests that island size may influence the occurrence of both species. Based on the theoretical models of niche and island biogeography, the overlapping distribution of both species in insular ecosystems could be related

Figure 2. A. Dorsal view of the specimen of *Mastigodryas melanolomus* found on Isla del Coral, Nayarit. **B.** Specimen of *M. melanolomus* collected on Isla del Coral, Nayarit. **C.** Dorsal view of the head of the *M. melanolomus* specimen.

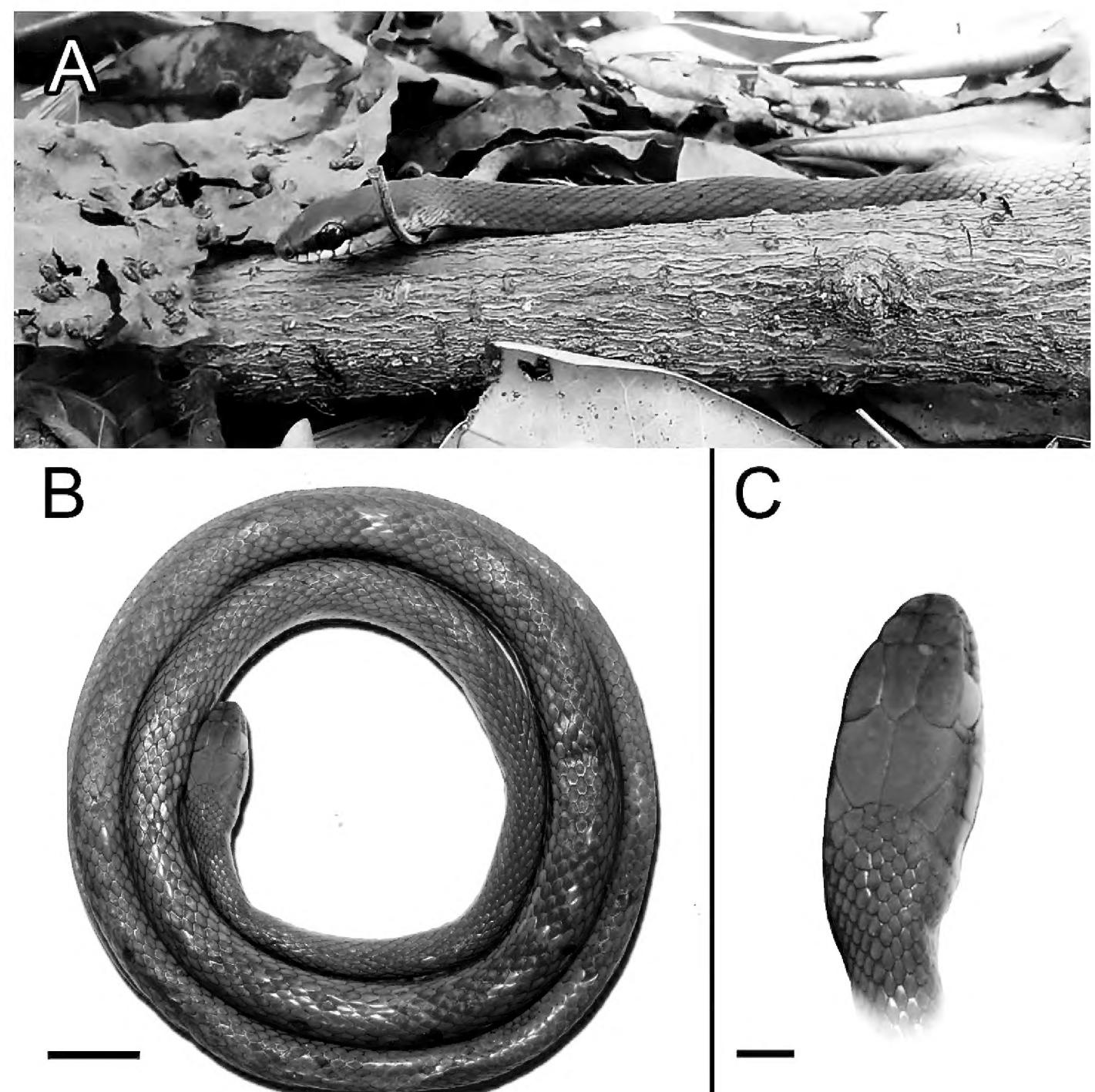
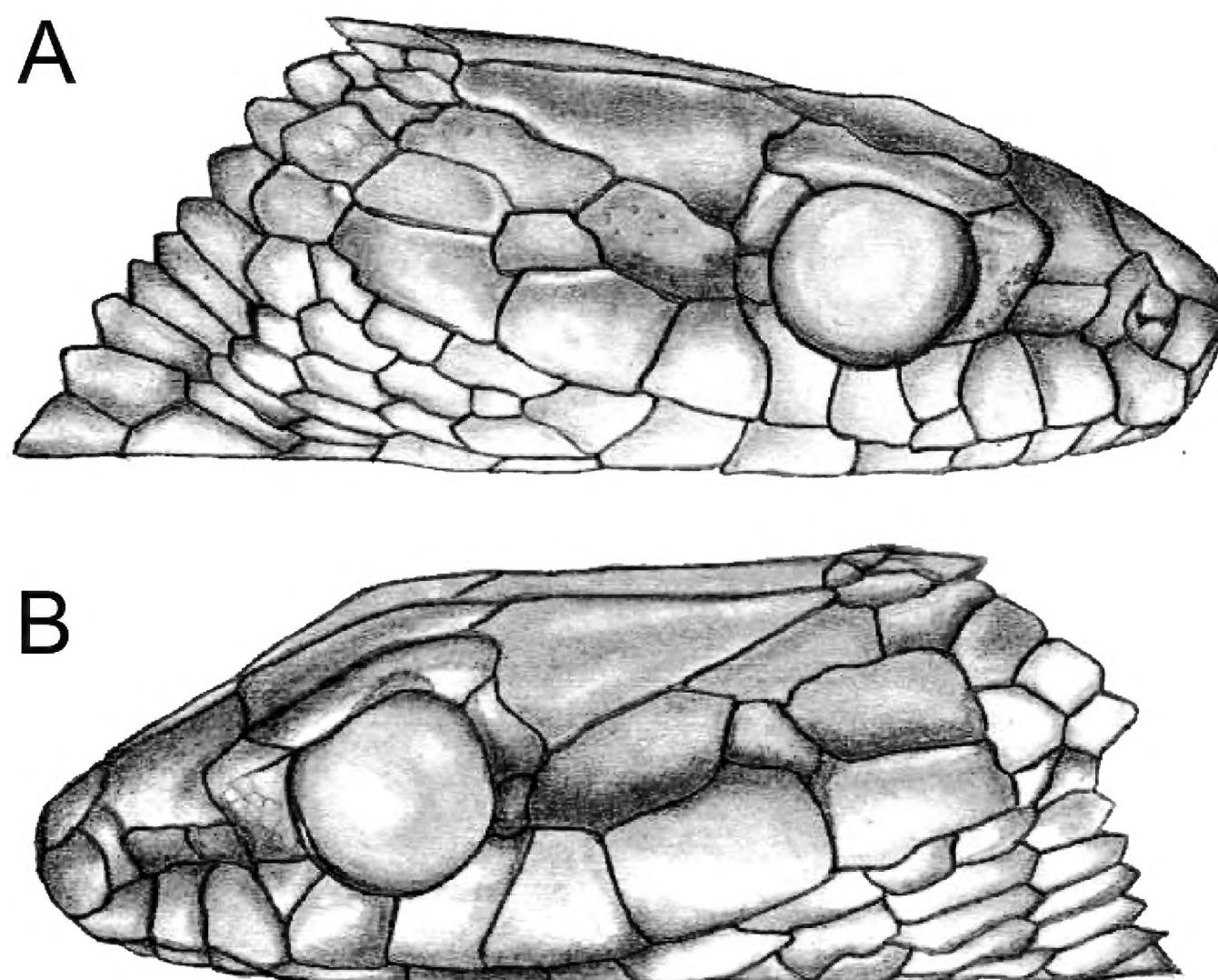


Table 1. Comparison of the captured snake from Isla del Coral with *Mastigodryas melanolomus* and *Masticophis lineatus* based on morphological characters.

Character	<i>M. melanolomus</i> (this study)	<i>M. melanolomus</i>	<i>M. lineatus</i>
Individuals analyzed (n)	1	5	13
Tail length/total length (%)	0.47	0.31–0.43	0.33–0.41
Ventrals	177	182–188	193–202
Subcaudals	122	82–116	91–134
Ventrals + subcaudals	299	217–293	294–331
Dorsal	15	15–16	13–17
Postoculars	2	2	2
Preocular	1	1	1–2
Contact with eye orbit	4th–6th	4th–6th	—
Supralabials	9	Usually 9	Usually 8
Infralabials	10	Usually 8	8–9

**Figure 3.** Head scutellation of *Mastigodryas melanolomus*, illustrating the condition of the 4th supralabial on each side of the head. **A.** View of the right side. **B.** View of the left side.

to increased habitat diversity on larger islands (Hortal et al. 2009). Nevertheless, this hypothesis requires further investigation in future studies.

On the other hand, there may be a misconception about the previous record of *Masticophis lineatus* on Isla del Coral. Unfortunately, we were unable to confirm the taxonomic identity of the specimen based on the description provided by Castro-Franco and Gaviño (1990). These authors mentioned that some reptiles were deposited in two Mexican scientific collections, but we have not found *M. lineatus* specimens from Isla del Coral in the database of the Colección Nacional de Anfibios y Reptiles at Universidad Nacional Autónoma de México (<https://datosabiertos.unam.mx/biodiversidad/>), and the other collection (Universidad Autónoma del Estado de Morelos) does not have a digital database to ascertain specimen information. In the light of our doubts, we politely wrote to Dr. Rubén Castro Franco, asking him to send us photos of the specimens reported in his paper (Castro-Franco and Gaviño 1990), with the aim to reduce any misinterpretations in the identification and occurrence of *Masticophis lineatus* in Isla del Coral. Unfortunately, to date, we have not seen the specimen reported by Castro-Franco and Gaviño (1990). One of the anonymous reviewers mentioned that the main difference between the genera *Masticophis* and *Mastigodryas* is the number of posterior scale rows. The above information suggests that it is important that Castro-Franco and Gaviño's specimen be found and its identity verified in order to clarify the occurrence of both species on the island.

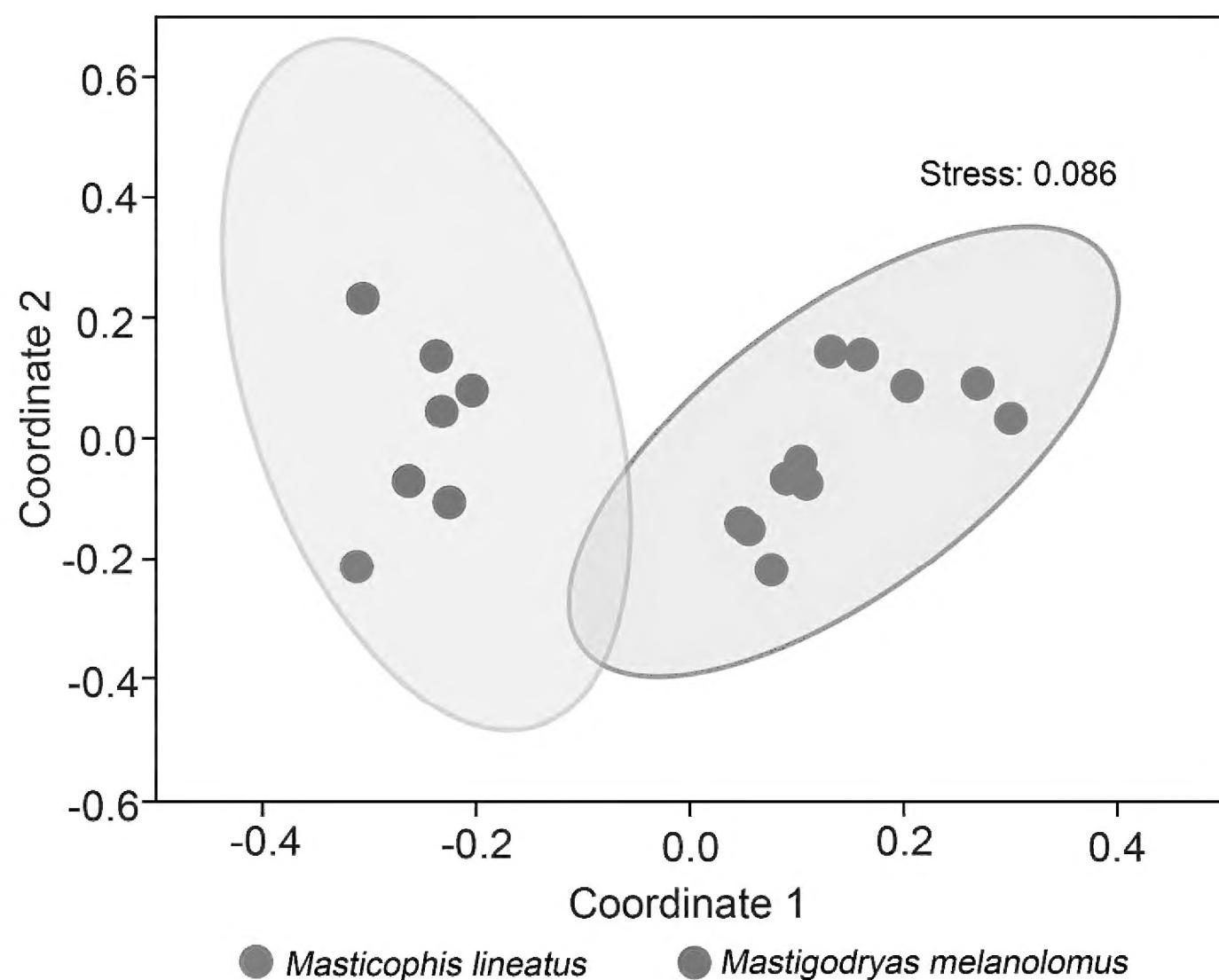


Figure 4. Non-parametric multidimensional scaling (NMDS) with 95% ellipses, showing the separation differences between *Mastigodryas melanolumos* (blue) and *Masticophis lineatus* (orange), and the position of snake from Isla del Coral (red).

It is possible that the specimen reported here might have simply dispersed from the mainland because the island is less than 2 km off the coast. For example, Deso et al. (2021) observed *Malpolon monspessulanus* (Hermann, 1804) swimming several hundred meters offshore of Port-Man Bay close to some islands, which are less than 3 km from the coast.

Despite its small size, Isla del Coral, it exhibits a higher diversity compared to Isla Isabel (0.98 km^2 , isolated by 28 km of water, seven reptiles; Rodríguez Malagón et al. 2012b), Islas Marietas (0.70 km^2 , isolated by 7.9 km of water, seven reptiles; Rodríguez Malagón et al. 2012a), and Isla San Juanito (8.0 km^2 , isolated by 152 km of water, six species; Casas-Andreu 1992). This suggests that the herpetofauna of some islands, such as Isla del Coral, could still be poorly sampled; therefore, it is necessary to increase research efforts on the islands to understand the alpha diversity of insular ecosystems in western Mexico.

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ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

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Author contributions

Conceptualization: EAG-H, AHE-G. Data curation: EAG-H, AHE-G. Formal analysis: EAG-H. Funding acquisition: AHE-G. Investigation: EAG-H, AHE-G. Methodology: EAG-H, AHE-G. Resources: AHE-G. Supervision:

AHE-G. Visualization: EAG-H, AHE-G. Project administration: AHE-G. Software: EAG-H, AHE-G. Validation: EAG-H, AHE-G. Writing – original draft: EAG-H, AHE-G. Writing – review and editing: EAG-H, AHE-G.

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Data availability

All data that support the findings of this study are available in the main text and Supplementary materials.

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